the combination of numerous independent size factors is criticized by GATES[6] (1) on the basis of cytological evidence (tetraploid chromosomes) to the contrary, and (2) on the basis of their sudden, discontinuous origin.—R. A. EMERSON.

Araucarians.—Miss HOLDEN[7] has recently described the stems of two fossil plants from eastern Canada, a *Tylodendron* from the south shore of Prince Edward Island and a form which she claims is *Voltzia coburgensis* from the Triassic at Martin's Head, New Brunswick. She has identified her specimens by the casts of the pith, and by the structure as well, and uses her determinations as evidence of the geological horizon of the strata in which they are found. In this connection, she states: "Since *Tylodendron* is characteristic of the Permian, there can be no question that these strata [those of Prince Edward Island] are of that age"; and of *Voltzia:* "Paleobotanical evidence indicates that the Mesozoic strata of New Brunswick are of the same age as those of the eastern United States, and should be correlated with the Lettenkohle or Lower Keuper of Europe." The pith casts of her *Tylodendron* are typical, and she states of the ligneous structure: "It agrees exactly with that described by DAWSON from Mr. BAIN's specimen as *Tylodendron Baini*, and with that described by POTONIÉ as *Araucarioxylon rhodeanum* Goepp."

In discussing the evidence for and against the generally accepted view of the araucarian affinity of *Tylodendron*, a view, however, from which Miss HOLDEN dissents, she agrees with POTONIÉ that "the nodal swellings and instanding protoxylem strands causing the ridges and furrows of the pith casts are identical with similar structures in *Araucaria* and *Agathis*," but states that instanding protoxylem strands are common to all living conifers. She admits that the medullary rays are typically araucarian, the rays uniseriate, rarely over 10 cells high, and composed of thin-walled cells, but she says that all conifers have uniseriate rays. Neither of her arguments, however, precludes the araucarian connection. Of the tracheary pitting, she says: "Its closely compressed and alternating pits clearly affiliate it with *Araucarioxylon* Krauss," but she considers that this does not indicate araucarian affinity, since "closely compressed and alternating pitting is not the primitive condition for the Araucarineae." This statement is made on the authority of Professor JEFFREY'S[8] recent work. While both of these articles were in press, however, the writer[9] advanced evidence

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[6] GATES, R. R., Tetraploid mutants and chromosome mechanisms. Biol. Centralbl. **33**:92–99, 113–150. 1913.

[7] HOLDEN, Miss R., Some fossil plants from eastern Canada. Ann. Botany **27**: 243–255. 1913.

[8] JEFFREY, E. C., The history, comparative anatomy, and evolution of the *Araucarioxylon* type. Proc. Amer. Acad. **48**:531–571. 1912.

[9] THOMSON, R. B., On the comparative anatomy and affinities of the Araucarineae. Phil. Trans. Roy. Soc. B **204**:1–50. 1913.

to show that the reverse is true. The pitting, for example, in the *cone axis* of *Araucaria Bidwillii* may be as much as 5-seriate, the pits alternating and extending from end to end of the tracheid. In this and in other primitive regions as well, the mouth of the pit is elliptical, a vestige of the more ancient scalariform condition, a condition which is retained even longer where the medullary ray touches the tracheid. No torus is present in these regions too, although this is well developed in the whole pine alliance. Again, Miss HOLDEN says: "Impressions present more evidence for merging *Tylodendron* with the araucarians. Several varieties of leafy branches, known as *Walchia*, and definitely associated with *Tylodendron* pith casts, have been described, all bearing a close resemblance to different species of *Araucaria*. Of their fructifications little is known, further than that, as shown by ZEILLER, the scales of the female cone bear single seeds, another araucarian feature." She presents nothing in opposition to the above statement, but in concluding the paragraph says: "If these criteria are reliable, the presence of *Tylodendron* in the Permian strata bears out the orthodox view that the Araucarineae are the oldest living family of the Coniferales." Since Miss HOLDEN has not invalidated any of these criteria, the case must hold for the araucarian connection. She evidently fears to draw this conclusion on account of the temerity of the advocates of araucarian ancestry of the conifers, for her final point is that "there are woods of the *Tylodendron* type extending as far back as the Culm, yet no advocate of the antiquity of the araucarian line would suggest that it extends as far back as that."

On the other hand, Miss HOLDEN considers that her more recent form *Voltzia coburgensis* from the Triassic is an araucarian, but one derived from the Abietineae. She accepts the conclusion as to the araucarian affinity of *Voltzia*, though she has rejected this conclusion in the case of *Tylodendron* which has one point more in its favor. The character of the rays, etc., of *Voltzia* is described as distinctly araucarian, just as in *Tylodendron*. The leaf trace is single at the pith, but forks during its passage through the wood, a similar condition, as Miss HOLDEN states, to that in *Agathis*. She has previously (p. 246) drawn attention to "the araucarian single trace" in *Tylodendron*. Of the pits in *Voltzia*, she says that they are "always uniseriate and usually scattered . . . . rarely are they so closely compressed as to be flattened and angular. While they are as distant as the pits of the Abietineae and Taxodineae, they are never, as is the rule in these groups, separated by so-called bars of Sanio." This pitting is the one point of difference from *Tylodendron*, where the pits are typically of the *Araucarioxylon* type, and the one point more in favor of the araucarian connection if the latter.

The anatomical evidence of abietinean affinity of *Voltzia* is said to be "the scattered position of the pits." Why this is distinctive of the Abietineae is not clear. She herself states (see the quotation in the preceding paragraph) that it is found in the Taxodineae, and it occurs in other conifers as well. Nor is it evident why the cone is abietineous, as Miss HOLDEN states. She refers to nine authorities, only one of which agrees that it is abietineous. Three refer

it to the Cupressineae and four put it with the Taxodineae, as the original describer, BRONGNIART, also did. No reasons are given for Miss HOLDEN'S choice.

After discussing the combination of araucarian and abietinean characteristics in *Voltzia*, she speaks of other forms showing similar combinations, and says: "Dr. JEFFREY . . . . appears to have demonstrated that the Abietineae are older, and that it is the Araucarineae which become progressively more and more like the Abietineae in successively older geological formations." Certainly this is not the case in the two forms she describes, even disregarding the evidence from the cone in both cases which is known in impression only. When, however, the cone impressions are given equal importance in each case, the foregoing conclusion is further at variance with the facts. Nor is the case improved by including the other transitional forms, which are considered important by the Harvard school, *Woodworthia* of the Triassic and *Araucariopitys* of the Cretaceous, since the former is practically an araucarian and the latter an abietinean. So far then as the evidence from the transitional forms stands, the reverse of the conclusion attributed to Professor JEFFREY is the fact. It is the Abietineae which are more like the Araucarineae in the older geological formations. When this evidence is taken in connection with the fact that no true Abietineae have been described from the strata preceding the Triassic, the historical evidence is seen to be wholly adverse to the Abietineae.

Miss HOLDEN'S own work then, far from supporting the abietinean ancestry of the Araucarineae, is directly opposed to it. Had the full evidence of the character of the ancestral pitting in the araucarians been before her, she would probably have escaped the pervasive influence of this theory.—R. B. THOMSON.

Pityoxylon.—One of Miss HOLDEN'S[10] three new species of Pityoxyla from the Middle Cretaceous of Cliffwood, N.J., is "probably the earliest form with all the characters of a modern hard pine, yet retaining certain ancestral features, as the association of primary and fascicular leaves." She has appropriately designated this form *Pinus protoscleropitys*. Its occurrence in the Middle Cretaceous is regarded as "an argument for the great geological antiquity of the pines as such." Her *Pityoxylon foliosum* is "possibly the wood of *Prepinus*, with all its leaves borne directly on the main axis," and combining the characteristics of both hard and soft pines. The third form, *Pityoxylon anomalum*, has much the same type of wood structure as the second, but has "all its leaves borne on short shoots."

The spur shoots are described as large in both forms, "much larger than those of living pines," but unbranched, as in modern pines, and thus unlike those of *Gingko*, or *Woodworthia* from the Triassic whose spurs were also large. The large size of the spurs in the old fossil forms is evidence that the spur was ancestrally a branch.

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[10] HOLDEN, Miss R., Cretaceous Pityoxyla from Cliffwood, New Jersey. Proc. Amer. Acad. **48**:609–623. 1913.